The Employment and Wage Effects of Export VAT Rebates: Evidence from China

Abstract

This paper studies the employment and wage effects of VAT rebates to exporters with comprehensive firm-product-level data of China. It is found that the adjustments in VAT rebates significantly and positively affect firm's employment but have no statistically significant effect on firm's wage. Moreover, this paper finds that the employment effect of VAT rebates is heterogeneous across firms. In particular, low-productivity firms are more sensitive to the adjustments of VAT rebates than high-productivity firms, suggesting that an increase of VAT rebates may cause mis-reallocation of resources.

Keywords: VAT rebates; Employment; Wage; Firm heterogeneity; Trade policy

JEL: F14, F16, H32, J23

1 Introduction

In open economies, trade policy has been considered as an important influencing factor of the labor market.[1] The input value-added tax (VAT) rebates to exporters have been a commonly-used and frequently-adjusted trade policy in China. On average, VAT rebates have accounted for 1.8% of GDP and 10.8% of government total tax revenue for the last 15 years.[2] The rates of VAT rebates have been adjusted more than 30 times since the country's tax system reform in 1994. However, the impact of VAT rebates on the labor market is so far unclear. Does the benefit from the rebates pass through to the labor market? Do firms increase employment and/or wage when receiving higher rebates? This paper empirically addresses these questions by studying the employment and wage effects of VAT rebates with comprehensive linked firm-product-level data.

Understanding the employment and wage effects of VAT rebates is important for two reasons. First, the trade literature of heterogeneous firms suggests that resource reallocation across firms is a natural consequence of trade liberalization, and it accounts for a significant part of the overall welfare effect of the trade policy.[3] The adjustments of VAT rebates provide a unique setting for evaluating the impact of this specific trade policy on labor (mis-)reallocation across firms. Our study adds labor market evidence to the above-mentioned general literature. Second, the analysis of VAT rebates can shed light on the potential effects of export tax on the labor market, on which the evidence is rather limited. As shown by Feldstein and Krugman (1990), when VAT is only partially rebated, the non-refunded part effectively acts as an export tax.[4] An increase in the rate of VAT rebates is then equivalent to a decrease of export tax. Utilizing the adjustments in the rates of VAT rebates in China, our study thus provides new evidence on the labor market effects of an export tax.

In practice, the rates of VAT rebates are set at the product level. However, the data of employment and wage is usually collected at the firm level. Therefore, we construct a firm-specific rate of VAT rebates and estimate the employment and wage effects of VAT rebates at the firm level. We define the firm-specific rate of VAT rebates as the average of the rates of VAT rebates of all products exported by a firm, weighted by the share of each product in the firm's total exports. Moreover, we follow Yu (2015) to use the export share of each

[1] For example, see Trefler (2004), Goldberg and Pavcnik (2005), Amiti and Davis (2012) and Krishna et al. (2014) on the effects of tariff reduction on the labor market. See Campa and Goldberg (2001), Verhoogen (2008), Nucci and Pozzolo (2010) and Dai and Xu (2017) on the effects of exchange rate shocks on the labor market.

[2] Calculated from China Statistical Year Book compiled by National Bureau of Statistics of China.

[3] For example, see Pavcnik (2002), Melitz (2003) and Trefler (2004).

[4] For example, Garred (2018) and Gourdon et al. (2019) calculate a measure of VAT export tax from the VAT rebates.

product calculated from firms' data in the initial year during the sample period. This is to mitigate the bias in the estimation of the employment and wage effects of VAT rebates, as the contemporaneous export weights may be correlated with a firm's employment and wage. Another estimation bias may arise when the changes in the product-level rate of VAT rebates are endogenous to firm's employment and wage. For example, many changes in the rates of VAT rebates are responses to export shocks, such as the changes after Asian financial crisis in 1997 and the global financial crisis in 2008. An endogeneity issue arises if export shocks affect firm's employment and wage through other channels (than affecting the rate of VAT rebates) that are not controlled for. However, we argue that the changes in the rates of VAT rebates in our analysis are plausibly exogenous to firm's employment and wage. We select the data from January 2003 to December 2006 for our analysis. During this period, as stated in the official circulars, the changes in the rates of VAT rebates were aimed at tackling domestic economic issues such as upgrading the economy structure, optimizing natural resource consumption and reducing environmental pollution. Braakmann et al. (2020) provide evidence that the changes in the rates of VAT rebates during this period were related to product characteristics, such as whether the product is resource-intensive, high-tech, pollutive or energy-consuming, and were unrelated to various measures of export shocks. Therefore, the changes in the rates of VAT rebates in our analysis are plausibly exogenous to firm's employment and wage.

Our preferred empirical specification finds that the adjustments in VAT rebates significantly affect firm's employment while having no statistically significant impact on firm's average wage. More specifically, a one percentage point increase in firm-specific rate of VAT rebates raises firm's employment by 0.236%. Compared with the employment growth of the firms whose VAT rebates are changed in our sample, the changes in VAT rebates reduce employment growth rate by around 3.6%. This indicates that the changes in VAT rebates are an important factor affecting firm's employment. There are two possible explanations of the employment effect: exports and financial constraints. On one hand higher VAT rebates give rise to the increase of export quantity and price, requiring firms to employ more labor (e.g. Chandra and Long, 2013; Gourdon et al., 2019; and Braakmann et al., 2020). On the other hand, the increases in VAT rebates essentially represent cash flows back to firms, potentially relaxing firms' financial constraints and enabling them to adjustment their employment.

Our estimated employment and wage effects of VAT rebates are qualitatively insensitive to various robustness checks. Firstly, we use alternative export share, including mean share from initial year to last year and export share lagged by one year and two years, to calculate firm-specific rate of VAT rebates. Secondly, we calculate firm-specific rate of VAT rebates considering product entry and exit within firms. The results using these alternative measures

of firm-specific rate of VAT rebates are very robust. Thirdly, we estimate employment and wage effects using small exporters as a safeguard to the exogenous adjustments of the rates of VAT rebate in our sample. The intuition is that small exporters are impossible to have a substantial impact on the adjustments of the rates of VAT rebates. Moreover, we conduct robustness checks about the roles of processing trade, product aggregation, bonded materials and export size. All results are consistent.

This paper further studies the heterogeneity of the employment and wage effects in firm productivity. Our results show that employment is more sensitive to the adjustments of VAT rebates in the firms with lower productivity while the wage effect is insignificant and indifferent between firms with different levels of productivity. Since our results suggest that an increase in VAT rebates raises employment more in the firms with lower productivity, an increase in VAT rebates may cause mis-allocation of resources. A policy implication is that the government should take actions to mitigate the distortions when it considers increasing the VAT rebates.

This paper contributes to the literature of export VAT rebates. The literature has mostly focused on VAT rebates' effects on exports. Theoretically, Feldstein and Krugman (1990) show that a partial rebate on VAT makes non-refunded VAT act as an export tax. This export tax is lower as the rate of VAT rebates becomes higher. As a result, VAT rebates are positively related to export. Chandra and Long (2013) provide firm-level evidence and Gourdon et al. (2019) provide product-level evidence for this prediction. Braakmann et al. (2020) provide additional evidence for this prediction with firm-product-level data. Tang et al. (2019) study the impact of VAT rebates on firm productivity and find that firm productivity is increased by higher rebates. There is also some literature explaining the motivations of the adjustments of the rates of VAT rebates, e.g. environmental considerations (Song et al., 2015; Gourdon et al., 2016; and Eisenbarth, 2017) and strategical support to downstream sectors (Gourdon et al., 2016; and Garred, 2018). The present paper studies the employment and wage effects of VAT rebates, providing a new dimension of the economic effects of VAT rebates.

This paper also adds to the wider literature on the effects of trade policy on the labor market. Trade liberalization has been found to be associated with the employment and wage.[5] In particular, Amiti and Davis (2012) theoretically and empirically show that the effects of tariff reductions for both input and output on wage are subject to firm-specific engagement into trade. They find that a fall in output tariffs decreases wages in import-competing firms but increases wages in exporting firms. Moreover, they find that a fall in

[5]For example, see Attanasio et al. (2004), Trefler (2004), Goldberg and Pavcnik (2005), LaRochelle-Côté (2007), Artuç et al. (2010), Amiti and Davis (2012), and Krishna et al. (2014).

input tariffs increases wages in import-using firms relative to those at firms that only use local inputs. Krishna et al. (2014) emphasize that the impact of tariff reductions on wage is affected by the quality of matching between workers and firms. The impact of exchange rate on the labor market has also been investigated by various studies.[6] In particular, Dai and Xu (2017) construct firm-specific exchange rate shocks and find a significant effect on the labor reallocation across firms. Our paper also highlights the firm-specific shocks due to the changes of trade policies and focuses on the trade policy of VAT rebates.

The rest of this paper is organized as follows. In section 2 we introduce the background and implementation of China's export VAT rebates. We present the empirical strategy in section 3 while describing the data in section 4. In section 5 we report the results of the employment and wage effects of VAT rebates and robustness checks. In section 6, we study the heterogeneity in firm productivity. Section 7 concludes the paper.

2 China's VAT rebates

2.1 Background

China started the policy of VAT rebates in 1994, in which exports were exempted from VAT and the paid input VAT for the production of exports was fully refunded.[7] The rates of VAT rebates have been changed many times since 1994. At the beginning, the adjustments were made in response to the heavy fiscal burden of the government and the rebates fraud.[8] However, in the past two decades, the adjustments of the rates of VAT rebates generally served two practical purposes.

The first and foremost purpose is to promote exports. As an export-promoting tool, the rates of VAT rebates have been frequently adjusted when exports face negative shocks, in particular, during the economic crisis. For example, after Asian financial crisis in 1997, as China's exports dropped, instead of depreciating Chinese currency to promote exports, the rates of VAT rebates were adjusted more than 10 times in 1998 and 1999. During this period, a large number of products received higher rates of VAT rebates. During 2008 and 2009, China's exports were hit by the global financial crisis. Consequently, the rates of

[6] For example, see Campa and Goldberg (2001), Klein et al. (2003), Verhoogen (2008), Nucci and Pozzolo (2010), Ekholm et al. (2012) and Dai and Xu (2017).

[7] Before 1994, China's trade policy of rebates for exports was based on industrial and commercial standard tax ("Gong Shang Tong Yi Shui" in Chinese).

[8] As documented by Cui (2003), the rebates from the government were increased by 150% to 75 billion yuan in 1994, in which 30 billion yuan were deferred to 1995 due to the state's budget constraint. To relieve the heavy fiscal burden and solve the fraud problem, the rates of VAT rebates for most products were lowered by 3 percentage points in 1995 and further decreased by 4 percentage points in 1996.

VAT rebates were increased for the products whose exports dropped most sharply, including textiles, clothing, furniture, toys and electromechanical products.

The other purpose is to upgrade the structure of the economy. For example, from 2003 to 2007, the rates of VAT rebates were adjusted more than 10 times. The main aims of theses adjustments were to reduce resource consumption and to reduce environmental pollution. For example, in *Fa Gai Jing Mao [2005] 1482 Hao and 2595 Hao*[9], the objectives of these circulars are clearly described as "to control the exports of high energy-consuming, high polluting and resource-based products". Stated in these circulars, one of the measures was to adjust the rates of VAT rebates of these products. Consequently, the adjustments from 2003 to 2007 were mainly reductions of the rates of VAT rebates for high energy-consuming and high polluting products (e.g. steel and chemical products), and resource-based products (e.g. rare earth metals, silicon and wooden products).

As this paper studies the employment and wage effects of VAT rebates, it is important to exclude the adjustments that happened in response to (negative) export shocks. The reason is that export shocks may also affect employment and wage through other channels than affecting VAT rebates. If we do not have proper control for these channels, an endogeneity issue will arise (we will discuss more on this problem in the identification issues discussed in section 3). Thus, we select adjustments of the rates of VAT rebates from January 2003 to December 2006, a period when the rates of VAT rebates were (officially) mainly adjusted to reduce resource consumption and to reduce environmental pollution. This is supported by Braakmann et al. (2020), who find that the adjustments during this period were not related to export shocks, but related to product characteristics, such as whether the product is resource-intensive, high-tech, pollutive and energy-consuming.

2.2 Implementation

The input VAT paid by firms for domestic sales is ultimately borne by consumers. Instead, the paid input VAT for exports is fully or partially refunded by the government because exports are exempted from VAT.[10] The process of full VAT rebates is illustrated in figure 1. Suppose a firm uses the input of 100 dollars to produce one unit of a product for the domestic sales. To purchase the input, the firm has to pay a VAT of 17%, i.e. 17 dollars. The

[9]Circular No. 1482 and 2595 were jointly issued by National Development and Reform Commission, Ministry of Finance, Ministry of Commerce, Ministry of Land and Resources, General Administration of Customs, State Administration of Taxation and Ministry of Environmental Protection.

[10]The importing countries often impose VAT to the imports to ensure an equal competitiveness between imports and domestic products. Therefore, to avoid double taxation the exporting countries do not impose VAT for exports.

product is sold at 120 dollars plus a output VAT of 17%, i.e. 20.4 dollars. The firm will use the output VAT, 20.4 dollars, to offset the input VAT, 17 dollars, and then pay the difference, i.e. 3.4 dollars, to the government. For this transaction, all the input VAT paid by the firm is finally borne by domestic consumers. The policy works differently for exporters. Suppose the same firm exports the same product. Because exports are exempted from VAT, the firm cannot collect output VAT from the importers in destinations. Therefore, the input VAT, i.e. 17 dollars, acts as a cost to the firm. Under the policy of VAT rebates, the firm can receive rebates to cover the cost of input VAT from the government. As shown in figure 1, the firm can receive the full value of input VAT, i.e. 17 dollars, from the government if the input VAT is fully rebated.

Figure 1 about here

In practice, the process of VAT rebates is more complicated for two reasons. First, the rebates are not always made in full. Take the above firm for example, the government may rebate only a part of the value of input VAT, i.e. setting a lower rate of VAT rebates than the rate of VAT. Second, for some inputs, firms do not have to pay VAT when purchasing them. As a result, no rebates are given for these inputs. A typical example is bonded materials, for which firms in China do not pay duty and VAT when importing them.

Formally, according to *Circular No. 7 Cai Shui [2002]*, the VAT rebates from the government for the eligible firms, disregarding the domestic sales, are:

$$\text{VAT Rebates} = Input\_VAT - (Exports - BM) * (VAT - VATR), \tag{1}$$

where $Input\_VAT$ is the value of VAT paid for the input that is used for the production of exports. VAT and $VATR$ are the rate of VAT and rate of VAT rebates, e.g. 17% and 13%, respectively. $Exports$ denotes the value of eligible exports.[11] BM denotes the value of inputs which are exempted from VAT, typically the bonded materials. The expenditure on these inputs is excluded from the export value for the purpose of calculating VAT rebates.

As shown in equation (1), if the rate of VAT rebates is equal to the rate of VAT, the VAT rebates are equal to the value of input VAT. That is to say, the firm is fully refunded of the paid VAT for the input used for the exports, which is the case illustrated in figure 1. However, if the rate of VAT rebates of a product is less than the rate of VAT, the VAT rebates are less than the value of input VAT, i.e. the value of input VAT is partially refunded. If the calculated VAT rebates are negative, instead of receiving rebates from the government,

[11] As we explain in section 4.2, non-eligible exports are typically the exports under processing trade with supplied materials, for which firms do not pay any input VAT.

the firm has to pay VAT to the government. For example, if the value of input VAT is very small and the value of exports is very large, the calculated VAT rebates can be negative. If the calculated VAT rebates are -100, the firm has to pay 100 as the VAT to the government.

3 Empirical strategy

In this section, we provide a simple illustration on how firm's employment is affected by the changes in VAT rebates. Then we describe the empirical specifications to estimate the employment and wage effects of VAT rebates.

3.1 A simple illustration

Suppose that the production of the exported product in a firm requires the labor l and the input k. The wage rate and the price of the input are w and p_k, respectively. The firm has to pay VAT when purchasing the input. The value of input VAT is $VAT(k)$. Assume that the production function takes a Cobb-Douglas form:

$$q = \varphi \cdot l^{\beta} k^{1-\beta} \tag{2}$$

where q is the output and φ is firm productivity. $0 < \beta < 1$. The fixed cost of producing and exporting the product is f. The firm's profit exporting q units at the f.o.b. export price p is then:

$$\pi = pq - (wl + p_k k) - f - VAT(k) + \text{VAT Rebates} \tag{3}$$

Combining the VAT rebates from equation (1) and ignoring the use of bonded materials, the profit can be written as:

$$\begin{aligned} \pi &= pq - (wl + p_k k) - f - VAT(k) + (VAT(k) - pq \cdot (VAT - VATR) \\ &= p(1 - VAT + VATR)q - (wl + p_k k) - f \end{aligned} \tag{4}$$

Equation (4) suggests that if the rate of VAT rebates is smaller than the rate of VAT, there is a tax burden for exporters. More specifically, the non-refunded VAT, i.e. $VAT - VATR$, acts as an export tax, which is in line with Feldstein and Krugman (1990). This export tax is lower as the rate of VAT rebates becomes higher. Therefore, the study of the impact of VAT rebates on the labor market can shed light on the potential impact of export tax on the labor market, on which the literature is very limited.

The firm's problem can be analyzed in two steps. The first step is to minimize the cost

$wl + p_k k$ by choosing labor l and inputs k given the output q described in equation (2), wage w and the price of input p_k. The second step is to maximize the profit by choosing the export price p given the market demand. In the optimum of the first step, we can find firm's employment for the production of exports as:

$$l = \frac{q p_k^{1-\beta} \beta^{1-\beta}}{\varphi w^{1-\beta} (1-\beta)^{1-\beta}} \tag{5}$$

and the marginal cost of the firm with productivity φ as:

$$c = \frac{w^{\beta} p_k^{1-\beta}}{\varphi \beta^{\beta} (1-\beta)^{1-\beta}} \tag{6}$$

The marginal cost is constant and not affected by VAT rebates. Therefore, the firm's profit exporting q units at the f.o.b. export price p can be rewritten as:

$$\pi = (p(1 - VAT + VATR) - c)\, q - f \tag{7}$$

To solve the second step, a demand function is required. Assume that the demand in foreign market is given as $Ap^{-\sigma}$, where A is a demand parameter and σ is the elasticity. For example, a CES preference can generate this demand function. Note that with such demand function, the markup is constant. As a result, the pass-through of any adjustments of VAT rebates is complete. We refrain from incomplete pass-through as we only aim at illustrating how firm's employment is related to VAT rebates. The iceberg-type variable trade cost is τ. Therefore, the export price including the variable trade cost is τp. As a result, the output to satisfy the foreign demand is $q = \tau A (\tau p)^{-\sigma}$. Substituting this demand equation into the profit equation (7), we can solve the optimal price p by maximizing the profit:

$$p = \frac{\sigma c}{(\sigma - 1)(1 - VAT + VATR)} \tag{8}$$

Then, the output q is:

$$q = A \tau^{1-\sigma} \left(\frac{\sigma c}{(\sigma - 1)(1 - VAT + VATR)} \right)^{-\sigma} \tag{9}$$

Substituting equations (6) and (9) into equation (5), we have firm's employment:

$$l = \frac{\delta A \tau^{1-\sigma} \varphi^{\sigma} (1 - VAT + VATR)^{\sigma}}{w^{1-\beta+\beta\sigma}} \tag{10}$$

where $\delta = \left(\frac{\sigma}{\sigma-1}\right)^{-\sigma} \frac{p_k^{(1-\beta)(1-\sigma)}\beta^{1-\beta+\beta\sigma}}{(1-\beta)^{(1-\beta)(1-\sigma)}}$. As shown in equation (10), an increase in the rate of VAT rebates raises firm's employment. Therefore, firm's employment is positively related to VAT rebates.

3.2 Empirical specifications

To guide our empirical analysis on the employment effect of VAT rebates, we take the logarithm form of equation (10) and have $\ln l = f(VATR, \ln w, \ln \varphi, \ln A, \ln \tau, \ln \delta)$. Therefore, our specification of the employment equation is:

$$\ln l_{it} = \gamma^l FVATR_{it} + \vartheta^l \ln X_{it} + \varsigma_i + \varsigma_t + \varepsilon_{it} \tag{11}$$

where $\ln l_{it}$ is the logarithm of employment, i.e. number of workers, of firm i in year t. $FVATR_{it}$ is firm-specific rate of VAT rebates. X_{it} is a set of control variables. ς_i represents firm fixed effects, which control for all the firm-level time-invariant factors, e.g. ownership, location and etc. ς_t represents year fixed effects. ε_{it} is the error term. Later we will explain how to construct firm-specific rate of VAT rebates and control variables. In addition to the employment effect of VAT rebates, we estimate the following equation to investigate the wage effect of VAT rebates:

$$\ln w_{it} = \gamma^w FVATR_{it} + \vartheta^w \ln Y_{it} + \varsigma_i + \varsigma_t + \varepsilon_{it} \tag{12}$$

where $\ln w_{it}$ is the logarithm of wage of firm i in year t. More specifically, the wage is measured as the total wage bill divided by the employment. Y_{it} is a set of control variables.

Firm-specific rate of VAT rebates

The rates of VAT rebates are set at the product level in practice. However, the data of employment and wage is collected at the firm level. Given a multi-product firm, it is hard to infer the product-level employment and wage from the firm-level employment and wage. Unfortunately, multi-product firms are prevalent (e.g. Bernard et al., 2010). Thus, we construct the a firm-specific rate of VAT rebates and estimate the employment and wage effects of VAT rebates at the firm level. The intuition behind the construction of firm-specific rates of VAT rebates is as follows. On the one hand, different firms export different products whose rates of VAT rebates may be adjusted differently; on the other hand, even when some firms export the same mix of products, the share of each product in their export portfolio is usually different. Thus, the perceived rates of VAT rebates are very different across firms.

According to equation (1), if ignoring bonded materials,[12] the value of VAT rebates of a firm i in year t that exports a set of products Ω_{it} is:

$$\text{VAT Rebates}_{it} = Input\_VAT_{it} - Export_{i,t} * \left(VAT - \sum_{j \in \Omega_{it}} \frac{Export_{ij,t}}{Export_{i,t}} VATR_{jt} \right)$$

where $Input\_VAT_{it}$ is the value of VAT that firm i pays for the input used for the production of exports in year t. $Export_{ij,t}$ is the value of eligible exports of product j of firm i in year t and $Export_{i,t} = \sum_{j \in \Omega_{it}} Export_{ij,t}$ is the value of eligible exports of firm i in year t. $VATR_{jt}$ is the rate of VAT rebates of product j in year t. For cases where the rates of VAT rebates of some products are adjusted within a year, $VATR_{jt}$ is constructed as the average of the rates of VAT rebates of product in that year. The firm-specific rate of VAT rebates can be defined as the second term in the bracket of the above equation, i.e. an export-weighted average of the rates of VAT rebates across products:

$$VATR_{it} = \sum_{j \in \Omega_{it}} \frac{Export_{ij,t}}{Export_{i,t}} VATR_{jt}. \tag{13}$$

If the exported products have the same rates of VAT rebates, the firm-specific rate of VAT rebates calculated as above is simply the rate of VAT rebates of the products.

However, the firm-specific rates of VAT rebates constructed in equation (13) could be endogenous. On the one hand, when the rate of VAT rebates of a product is increased, the export value of the product increases (e.g. Chandra and Long, 2013; Gourdon et al., 2019; and Braakmann et al., 2020). As a result, the export weights may be correlated with the rates of VAT rebates. If the export weights are positively correlated with the rates of VAT rebates, there will be an upward bias in the firm-specific rate of VAT rebates.[13] On the other hand, the allocation of exports across products is an endogenous decision. For example, high-quality products require skilled labor to produce (Verhoogen, 2008). Thus, the exports of different products (with different quality) may be decided by firms' skill intensity of the employment. Another example is that the products within a firm usually have different capital intensities (Ma et al., 2014) and consequently their exports may be decided by the firm's capital intensity.

To mitigate the endogeneity concern associated with the export weight, we follow Yu (2015) to measure the export weight of each product using a firm's initial year's data in the

[12] We ignore the bonded materials when calculating firm-specific rates of VAT rebates in the main analysis. In one of our robustness checks, we explain the reason and explicitly address this concern.

[13] The intuition is similar to the downward bias in the measurement of firm-specific tariff when using contemporaneous import weights (e.g. Yu, 2015).

sample:

$$FVATR_{it} = \sum_{j \in \Omega_{it}} \frac{Export_{ij,Initial\_year}}{Export_{i,Initial\_year}} VATR_{jt} \tag{14}$$

With this method, the export weights are time-invariant. Therefore, the firm-specific rate of VAT rebates is not correlated with the reallocation of exports across the products.

Control variables

In the employment equation (11), the control variables include firm wage, firm productivity, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Firm wage corresponds to $\ln w$ in the model. Firm productivity, corresponding to $\ln \varphi$ in the model, is measured by value added per capita.[14] Firm-level demand shocks in the foreign market correspond to the parameter $\ln A$ in the model. We measure firm-level demand shocks with two variables: $\ln\left(\sum_{c \in C_{it}} \frac{Export_{ic,t}}{Export_{i,t}} Pop_{ct}\right)$ and $\ln\left(\sum_{c \in C_{it}} \frac{Export_{ic,t}}{Export_{i,t}} GDPPC_{ct}\right)$. Pop_{ct} and $GDPPC_{ct}$ are the total population and GDP per capita of county c in year t, respectively. C_{it} is the set of countries that firm i exports to in year t. $Export_{ic,t}$ is the value of exports of firm i to country c in year t and $Export_{i,t} = \sum_{c \in C_{it}} Export_{ic,t}$ is the total value of exports of firm i in year t. These two variables measure the population of the countries served by a firm and their income levels. Firm-level variable trade cost, corresponding to $\ln \tau$ in the model, is measured by $\ln\left(\sum_{c \in C_{it}} \frac{Export_{ic,t}}{Export_{i,t}} Dist_{ct}\right)$, in which $Dist_{ct}$ is the distance between country c and China. Capital intensity and the share of value-added in total output are used to control for the parameters of production function that are included in the δ of the model. As VAT rebates are based on the eligible exports, we use the share of domestic sales in total sales and the share of non-eligible exports in total exports to control for the impacts of domestic sales and non-eligible exports.

The control variables in the wage equation (12) are selected to control for the factors that affect how wages are set across firms. For example, a line of research suggests that firms consider efficiency or fair wages as a mechanism to induce workers' effort (e.g. Egger and Kreickemeier, 2009; Davis and Harrigan, 2011; Amiti and Davis, 2012). Therefore, we

[14] The results are very robust when using total factor productivity (TFP) estimated from Levinsohn and Petrin (2003) approach in which materials are used to control for the unobservable productivity as a control variable. In Appendix A.5, we also show the results with TFP estimated from Olley and Pakes (1996) approach in which investment is used to control for the unobservable productivity as well as Ackerberg et al. (2015) approach. All results are robust.

include labor productivity, i.e. value-added per capita, in the specification.[15] Another strand of literature finds that search and matching frictions in the labor market result in bargaining power of workers in the negotiation of wage (e.g. Davidson et al., 2008; Helpman and Itskhoki, 2010; and Helpman et al., 2010). Therefore, we add control variables measuring the characteristics of local labor market where the firm is located, including unemployment rate, labor market tightness, and labor market matching efficiency. More specifically, we calculate the ratio between job vacancies and job seekers that are registered in the careers services, as an indication of labor market tightness. The labor market matching efficiency is measured by the share of placed job-seekers in total job-seekers registered in the careers services. These labor market characteristics have been considered as important factors when workers negotiate wages with employers (e.g. Helpman and Itskhoki, 2010; and Helpman et al., 2010). All other control variables used in the employment equation (11) are also included in the estimation of the wage equation.

Identification issues

The key parameters of interest are γ^l and γ^w, which capture the employment and wage effects of VAT rebates respectively. The estimation of γ^l and γ^w could be biased due to the potential endogeneity of $FVATR_{it}$. When calculating $FVATR_{it}$ with the initial export share, the only source of changes in $FVATR_{it}$ is the changes in product-level rates of VAT rebates. However, the changes in product-level rates of VAT rebates can be endogenous. For example, a number of changes in the rates of VAT rebates are responses to the export shocks during economic crisis, e.g. Asian financial crisis in 1997 and the global financial crisis in 2008. The endogeneity issue arises if these export shocks affect firm's employment and wage through other channels that are not controlled for. For example, Chodorow-Reich (2014) and Popov and Rocholl (2018) show that credit market disruptions due to economic crisis have considerable effects on the firm's employment. Dai and Xu (2017) show that exchange rate shocks affect firm's employment significantly. Apparently, export shocks may be accompanied by credit market disruptions during economic crisis and exchange rate shocks, thereby affecting firm's employment. As a result, the estimated employment and wage effects of VAT rebates will be subject to a downward bias.[16]

However, the impact of this source of endogeneity on our estimation should be fairly minor. The reason is that we select the period from January 2003 to December 2006 in

[15] The results are robust if we control for total factor productivity as in the employment equation.

[16] More specifically, the rates of VAT rebates are usually increased in response to the negative export shocks. Therefore, the estimated (positive) effect of VAT rebates is offset by the negative effect of credit market disruptions and exchange rate shocks.

our sample. During this period, the adjustments of the rates of VAT rebates were aimed at upgrading the economy structure, optimizing natural resource consumption and reducing environmental pollution. These objectives are clearly stated in the official circulars, which have been discussed in section 2. As documented by Braakmann et al. (2020), the adjustments during this period were indeed related to product characteristics, such as whether the product is resource-intensive, high-tech, pollutive and energy-consuming; but were unrelated to various measures of export shocks. Therefore, the changes in the rates of VAT rebates in our analysis are plausibly exogenous.

4 Data

Our study draws on three main sources of disaggregated data: product-level rates of VAT rebates, transaction-level trade and firm-level production.

4.1 Rate of VAT rebates

Firstly, we collect the rates pf VAT rebates of all products after the last adjustment in our sample period, i.e. September 2006, from the website of Minister of Commerce.[17] Secondly, we collect all the circulars on the adjustments of VAT rebates between January 2003 and December 2006 in SAT Taxation Law Database.[18] These circulars state the changes of the rates of VAT rebates for the adjusted products. Since our data on exports is at 8-digit HS level, we drop the few 8-digit HS products that have different rates of VAT rebates or the adjustments of the rates of VAT rebates at 10-digit or 11-digit HS level. With this exercise, we have monthly rates of VAT rebates for 7,308 8-digit HS products from 2003 to 2006.

In our sample, around 1,800 (240) products experienced negative (positive) adjustments of VAT rebates. In total, the rates of 28% of products, i.e. 2,055 products, were adjusted. Among them, around 100 products were adjusted more than once.[19] The changes in the rate of VAT rebates were between -17 percentage points and 13 percentage points. As shown in figure 2, most (around 40%) of the changes are the reductions in the rate of VAT rebates by 2 percentage points, which involves around 900 products. The second most (around 20%) of the changes are the reductions by 13 percentage points involving around 450 products. The third and fourth most (around 15% and 8%) of the changes are the reductions by 5

[17] http://cws.mofcom.gov.cn/accessory/200703/1174376723900.xls accessible on 15 August 2017.

[18] See Appendix A.1 for details.

[19] More specifically, 1,949 products, 85 products, 18 products and 3 products were adjusted once, twice, three times and four times, respectively.

percentage points involving around 330 products and the increases by 4 percentage points involving around 180 products, respectively. The fifth most (around 6%) of the changes are the reductions by 8 percentage points involving around 140 products. Compared with the maximum rate of VAT rebates, 17%, these changes were substantial. For most adjustments, the period between the announcement and the time of these adjustments coming into effect varied from one day to ten days. This indicates that the anticipation effects, i.e. firms adjusting employment and wage in anticipation of adjustments coming into effect, are highly unlikely.[20]

Figure 2 about here

4.2 Transaction-level trade

Our export transactions are from Chinese Customs Trade Database (CCTD) collected by the General Administration of Customs of China. This database reports export (and import) values and quantities by product-firm-destination (source country for imports) at a monthly frequency. Moreover, the trade mode is recorded for every transaction. There are three major trade modes, i.e. "processing trade with purchased materials (PTPM)", "processing trade with supplied materials (PTSM)" and "ordinary trade (OT)", which account for more than 90 percent of the exports.[21] Under PTPM, firms purchase materials from abroad as an input used in the production of exports. During the process, firms have to pay input VAT for the materials from abroad. Therefore, the exports under PTPM are eligible for VAT rebates. However, under PTSM, firms are supplied with the materials from abroad and mainly conduct assembly work. During the process, firms do not pay any input VAT for the supplied materials and only get assembly fees after shipping the output abroad. Therefore, exports under PTSM are not eligible for VAT rebates. We use eligible exports, i.e. exports under OT and PTPM, to construct firm-specific rates of VAT rebates. We clean the data by dropping observations with missing values on any of the following variables: product HS code, firm name, export value and export quantity.

4.3 Firm-level production

The firm-level production data comes from Chinese annual survey of manufacturing firms (CASMF) collected by the National Bureau of Statistics of China. There are around 100

[20] The adjustments in January 2004 were an exception, for which the time gap is 75 days as shown in table A1 in Appendix A.1. However, Braakmann et al. (2020) explicitly test the possible anticipation effects of these adjustments and find no evidence of anticipation effects.

[21] See Appendix A.2 for the definitions of trade modes of PTPM and PTSM.

thousand firms in 1999 to 410 thousand firms in 2008. The survey records information on firm's employment and wage. The survey also records firm-level data on asset, intermediate input, sales, exports and etc. We clean the data by dropping observations that satisfy any of the following criteria: (1) missing values on firm name or duplicated firm name in each year; (2) missing values or non-positive values on firm employment and total wage bill; (3) non-positive values of sales and total asset; (4) export value larger than total sales; (5) fixed asset or variable asset larger than total asset.

4.4 Merged data

To construct firm-specific rates of VAT rebates, we merge product-level rates of VAT rebates and transaction-level trade to get detailed information on the exports for each exporter, including the products exported and exports for each product. This exercise provides us a sample of around 87,000 exporters in 2003 and around 160,000 exporters in 2006. Then, we merge it with the production-level data to get the sample for the empirical regression.[22]

In the merged data, we have around 27,000 firms in 2003 and around 51,000 firms in 2006. On average, The merged data accounts for 35% of exporters and nearly 50% of export value in CCTD. It also accounts for 58% of exporters and 67% of export value in the cleaned CASMF. Moreover, the merged data contains more than 50% of the sales, employment and asset of exporters in the cleaned CASMF. As a comparison, in the merged data of Yu (2015), 40% of the exporters and 53% of the export value in CASMF are covered. Therefore, our merged data is very comparable to Yu (2015).

5 Results

5.1 Baseline results

The results on the employment and wage effects of VAT rebates are reported in table 1.[23] As shown in columns (3) and (4) of panel A, the employment effect becomes significantly positive as we include firm and year fixed effects. Our preferred specification from equation (11) with control variables is shown in column (4), in which the coefficient of $FVATR$ is significantly positive at the value of 0.236. This suggests that a one percentage point decrease

[22] The details of the merged data, including the number of firms and the description of merging quality for each year, and the descriptive statistics of the data used for our regressions are presented in Appendix A.2.

[23] The full tables on the employment and wage effects, showing the coefficients of all control variables, are presented in Appendix A.3.

(increase) of firm-specific rate of VAT rebates significantly reduces (raises) employment by 0.236%.

However, as shown in columns (3) and (4) of panel B, the wage effect of VAT rebates is not significant when including firm and year fixed effects. Our preferred specification from equation (12) with control variables is presented in column (4). The coefficient is very small and statistically insignificant, suggesting VAT rebates have no significant impact on firm's average wage. Combining the employment and wage effects together, we find that firms receiving higher (lower) VAT rebates employ more (less) workers but do not pay higher or lower average wage. This is probably because China had a big labor pool during the period in our sample. As a result, firms can expand the employment without paying higher wage.

Table 1 about here

To understand the scale of the employment effect, we calculate firms' employment growth from the initial year to the last year in our sample and the adjustments of employment induced by the changes in VAT rebates. The employment growth is calculated as $\Delta \ln l$ from the initial year to the last year. The adjustments of employment induced by the changes in VAT rebates are calculated in two steps. Firstly, we calculate the change in the firm-specific rate of VAT rebates for each firm from the initial year to the last year, $\Delta FVATR$. Secondly, we apply the estimated coefficients of $FVATR$ to calculate adjustments of employment induced by the changes in VAT rebates, i.e. $0.236 \times \Delta FVATR$. On average, the employment growth for the firms whose VAT rebates are changed in our sample is 7.3%. There is an overall decrease in the rates of VAT rebates during this period, thereby reducing employment by 0.26%. Therefore, the changes in VAT rebates reduce employment growth by around 3.6%.[24] This indicates that the changes in VAT rebates are a important factor affecting firm's employment.

There are two potential explanations of the employment effect of VAT rebates. The first explanation is about exports: higher VAT rebates give rise to the increase of export quantity and price, requiring firms to employ more labor. There has been evidence in the literature that higher VAT rebates raise export quantity (e.g. Chandra and Long, 2013; Gourdon et al., 2019; and Braakmann et al., 2020). In Appendix A.4, we estimate the effects of firm-specific rate of VAT rebates on firm's exports using our firm-level data. Indeed, we find higher VAT rebates significantly increase firm's export value, export quantity and export price (firm's

[24]Note that the change in firm-specific rate of VAT rebates is smaller than the product-level changes in the rate of VAT rebates. Using the changes in the product-level rates as shown in figure 2, the employment effect would be much larger.

export value divided by export quantity).[25] The second potential explanation is about financial constraints. Financial constraints have been considered an important factor when firms make decisions in the labor market (e.g. Michelacci and Quadrini, 2005; Caggese and Cuñat, 2008; Borisov et al., 2015; Falato and Liang, 2016; and Benmelech et al., 2019). The increases in VAT rebates essentially represent cash flows back to firms, potentially relaxing firms' financial constraints and enabling them to adjust their employment. This is relevant in the context of China given the tight financial constraints faced by many Chinese exporters (e.g. Manova and Yu, 2016). In Appendix A.4, we show that an increase of VAT rebates indeed raises firms' liquidity and decreases firm's leverage, suggesting that higher VAT rebates make firms become less financially constrained.

5.2 Robustness check

In this section, we present some robustness checks of the employment and wage effects.

5.2.1 Alternative export share

In the main analysis, we use initial export share of each product to calculate firm-specific rate of VAT rebates. The idea is that the time-invariant export share is not correlated with any contemporaneous shocks on firm's employment and wage. As a robustness check, we use the mean export share of each product from the initial year to the last year in our sample, which is also time-variant, to calculate firm-specific rate of VAT rebates. The employment and wage effects are presented in column (1) of table 2, respectively. The results are very robust. Moreover, we use lagged export share of each product by one year and two years, which are not correlated with contemporaneous shocks, to calculate firm-specific rate of VAT rebates. The results are presented in columns (2)-(3) of table 2, respectively. Again, they are consistent with the main results.

5.2.2 Product entry and exit

In our calculation of firm-specific rate of VAT rebates, the initial export share is not available for the products that are newly added by a firm after the initial year. Moreover, if a firm drops products after the initial year, the initial export shares of the survival products cannot be used. Therefore, for the firms that add or drop products after the initial year, it is not feasible to use the initial export share to calculate firm-specific rate of VAT rebates. Here,

[25] If we consider export price as a proxy of export quality, the result suggests that firms may upgrade export quality with higher VAT rebates, which may require more (skilled) labor.

we provide a robustness check on this issue. For every firm, we construct its product mix that consists of all products exported from the initial year to the last year in our sample. Then, the export shares of the products that are not exported in a year are treated as zero. For example, if a firm exports $ 400 of product A and $ 600 of product B in 2003 and exports $ 500 of product A and $ 500 of product C in 2004, the product mix of this firm consists of A, B and C. The export shares of A, B and C are 40%, 60% and 0% in 2003, and are 50%, 0% and 50% in 2004. Again, we use the initial export share to calculate firm-specific rate of VAT rebates and use mean export share to calculate an alternative firm-specific rate of VAT rebates. The employment and wage effects are presented in columns (4) and column (6) of table 2, respectively. They are very consistent with the main results. Additionally, we check the results controlling for product entry and exit. More specifically, we include a dummy variable to denote whether the firm drops a product and a dummy variable to denote whether the firm adds a product in the control variables. The employment and wage effects are presented in columns (5) and (7). The results are again consistent with the main results.

Table 2 about here

5.2.3 Small exporters

As a safeguard to the exogenous adjustments of the rates of VAT rebates in our sample, we estimate the effects using a sample of small exporters. The intuition is that small exporters are impossible to have an impact on the adjustments of the product-level rates of VAT rebates. We construct the sample of small exporters using two methods. In the first method, a small exporter is a firm whose export share of every product, i.e. the firm's export value of the product out of the total export value of the product, is less than 5%. The results are shown in column (1) of table 3. They are very consistent with the main results. In the second method, a small exporter is a firm whose total export value is below the 20th percentile in the firms in the same sector. The results are shown in column (2). The results are consistent with the main results.

5.2.4 Processing Trade

As described in section 4.2, exports under PTPM and OT are both eligible for VAT rebates. However, as discussed in Manova and Yu (2016), the exporting behavior of firms conducting PTPM is different from firms conducting OT. To attenuate the concern that the employment and wage effects of VAT rebates may be affected by PTPM, we investigate the effects by excluding firms conducting PTPM as a robustness check. The results are presented in columns

(3) of table 3. The employment effect is significantly positive while the wage effect is not significant.

5.2.5 Product aggregation

The rate of VAT rebates for exports is set and changed at 8-digit HS product level. It is interesting to study whether the product aggregation affects the employment and wage effects.[26] As a robustness check, we aggregate the data at 6-digit HS product level. More specifically, we calculate 6-digit HS product level rate of VAT rebates as the average of the rates across all sub-8-digit HS products and use the initial export share of each 6-digit HS product to calculate firm-specific rate of VAT rebates. The results are presented in column (4) of table 3 and are consistent with the main results.[27]

5.2.6 Bonded material

As shown in section 2.2, bonded materials should be excluded from the value of exports when calculating VAT rebates. However, in the main analysis we ignore bonded materials when calculating firm-specific rate of VAT rebates. The main reason is that only a small portion of firms use bonded materials in our sample. For those firms using bonded materials, the value of bonded materials is usually small relative to the value of exports. Moreover, we do not observe how bonded materials are used across products within a firm. Here, we provide a robustness check assuming that bonded materials are used within the same 8-digit HS product. Since we observe the bm_{ijt} for each 8-digit HS product j of firm i in year t, we can easily exclude them from exports. Therefore, we use $x_{ijt} - bm_{ijt}$ to replace x_{ijt} when calculating firm-specific rate of VAT rebates. The results of the employment and wage effects are reported in column (5) of table 3, and are similar to the main results.[28]

5.2.7 Export size

As domestic sales are not eligible for VAT rebates, it is crucial to control for the importance of exports for each firm. For example, a firm with a large (small) change in firm-specific

[26] For example, Gourdon et al. (2019) estimate the effect of rebates on exports at 6-digit HS product level. The aggregation is also able to partly alleviate the issue of product entry and exit.

[27] The employment and wage effects based on the aggregation at 4-digit HS product level are also very consistent.

[28] We have also checked the results assuming that bonded materials are used within the same 6-digit (4-digit) HS product. We first aggregate bonded materials at 6-digit (4-digit) HS product level for every firm and then allocate bonded materials to 8-digit HS products according to their export shares in total 6-digit (4-digit) HS product level export. The results are very consistent.

rate of VAT rebates could have a very small (large) amount of export. Then, the employment and wage effects of VAT rebates may be small (large) on this firm. In the main analysis, we have dealt with this problem using the share of domestic sales in total sales as one of the control variables. Therefore, the employment and wage effects are estimated by comparing firms with a similar level of exports. To further provide robustness checks on this issue, we scale firm-specific rate of VAT rebates by multiplying it with the initial share of exports in total sales.[29] With the scaled firm-specific rate of VAT rebates, export size of firms is taken into consideration. The results are reported in column (6) of table 3. Again, the employment effect is significantly positive while the wage effect is not significant.

Table 3 about here

5.2.8 Other robustness checks

Our estimation may be affected by the selection bias due to firm's exit from foreign markets. The bias arises when decision to exit is affected by VAT rebates. For example, even conditional on the control variables and fixed effects used in equations (11) and (12), a firm with higher VAT rebates may export strategically just to reap VAT rebates. In this case, firms with higher VAT rebates are more likely to survive in the foreign market. Following Olley and Pakes (1996), we address this potential bias by modeling the probability to survive in the foreign market as a function of observed variables and using the predicted probability to survive as an additional control variable to estimate the employment and wage effects. Another practical concern is that it may take time for the employment and wage to adjust to the changes in VAT rebates. There is also a concern about the reverse causality between employment/wage and VAT rebates as the initial year's export weights may be affected by the initial year's employment and wage. To attenuate these concerns, we investigate the effects of lagged firm-specific rate of VAT rebates by one year on the contemporaneous employment and wage. Moreover, we estimate the employment (wage) effect by excluding the outliers whose employment (wage) is at the top 5% or the bottom 5% of all firms in each sector. The results are presented in Appendix A.5 and are consistent with the main results.

6 Heterogeneity in firm productivity

Firm productivity has been a very important dimension of heterogeneity in the literature of international trade. In this section, we investigate whether the employment and wage effects

[29] It is equivalent to replace the initial export share of each product in firm total export with the initial export share of each product in firm total sales in equation (14).

are heterogeneous across firms with different levels of productivity.

We firstly estimate firms' total factor productivity (TFP) using Levinsohn and Petrin (2003) approach in which materials are used to control for the unobserved productivity.[30] Then, we use firms' TFP at their initial year to divide the sample into two groups: low-productivity firms and high-productivity firms. More specifically, within each sector, the firms with productivity lower than the median value are classified as low-productivity firms while the rest firms high-productivity firms.[31] Finally, we estimate the employment and wage effects for each group.

The results are presented in columns (1) and (2) of table 4. As shown in panel A, the coefficient of $FVATR$ in the employment equation is significantly positive at 0.313 in low-productivity firms and not significant in high-productivity firms. This suggests that a one percentage point decrease (increase) in firm-specific rate of VAT rebates reduces (raises) low-productivity firms' employment by 0.313% while having no statistically significant impact on high-productivity firms' employment. As shown in panel B, the wage effect is not significant in both low-productivity and high-productivity firms. In Appendix A.6, we report the robustness checks with TFP estimated from various methods, including Olley and Pakes (1996) approach and Ackerberg et al. (2015) approach. In all these measures of firm productivity, the pattern about the heterogeneity of the employment and wage effects in firm productivity holds.

To provide further evidence on the heterogeneity in firm productivity, we estimate equations (11) and (12) with an interaction term between firm-specific rate of VAT rebate and the values of firms' TFP. Firstly, we use firms' TFP in their initial year. The results are presented in column (3) of table 4. As shown in panel A, the coefficient of the interaction term is significantly negative in the employment equation while being insignificant in the wage equation as shown in panel B. Secondly, we use firms' TFP in 2003. The results are presented in column (4). Again, the coefficient of the interaction term is significantly negative in the employment equation but not significant in the wage equation. Thirdly, we use firms' contemporaneous TFP. As shown in column (5), the results are very consistent: the coefficient of the interaction term is significantly negative (not significant) in the employment (wage) equation. These results suggest that the employment effect is larger in the firms with lower productivity while the wage effect is insignificant and indifferent between firms with different levels of productivity.[32] This finding is consistent with the previous specification

[30] We use sector-wide price index as in Brandt et al. (2012) to deflate the value of output, capital and material.

[31] It is worth noting that VAT rebates may have an impact on firms' TFP (Tang et al., 2019). Therefore, the changes in VAT rebates may affect firms' classification of groups. As a result, we use TFP at the initial year to address this issue. The results are very robust when using the TFP in the first year, i.e. 2003, to classify firms.

[32] In Appendix A.6, we show that the results are robust when controlling for additional interaction terms

that firms are divided into low-productivity and high-productivity firms. As a result, an implication to policymakers is that when considering a decrease of VAT rebates, it is important to provide support to low-productivity firms to mitigate the negative effect on employment.

Table 4 about here

Our analysis consistently suggests that the employment is more sensitive to the adjustments of VAT rebates in the firms with lower productivity. In our sample period, there is an overall decrease in VAT rebates. Therefore, employment is reduced more in the firms with lower productivity. The possible explanation to this heterogeneity is that firms with lower productivity are less capable of passing through the negative shocks, i.e. the decrease of VAT rebates, to consumers (i.e. the importers in the foreign countries), thereby having to absorb more of the shocks internally and reducing the employment more. This is consistent with the findings in Braakmann et al. (2020) that smaller exporters and exporter charging lower prices (which tend to be less productive in China) have very limited abilities to increase export price when receiving lower VAT rebates. The lower abilities to pass through shocks to consumers in firms with lower productivity are also consistent with the theoretical models of endogenous markup and incomplete pass through of shocks in trade literature (e.g. Melitz and Ottaviano, 2008; and Berman et al., 2012). Moreover, since our results suggest that an increase in VAT rebates raises employment more in firms with lower productivity, an increase in VAT rebates may cause mis-allocation of resources.

7 Conclusion

VAT rebates are a commonly used trade policy. This paper studies the employment and wage effects of VAT rebates using a comprehensive Chinese firm-product-level data set. The paper highlights the role of firm-level heterogeneity when firms are exposed to product-level adjustments of the rates of VAT rebates. Our results show that higher VAT rebates raise firm's employment while having no impact on firm's average wage. Moreover, we find significant heterogeneity of the employment effect across firms with different levels of productivity. In particular, an increase of VAT rebates raises employment more in the firms with lower productivity. This suggests that the policy of increasing VAT rebates may distort the factor market and lead to inefficient use of resources. A policy implication is that the government should take actions to mitigate the distortions when it considers increasing the VAT rebates.

between firm-specific rate of VAT rebates and capital (and skill) intensity.

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Figures and tables

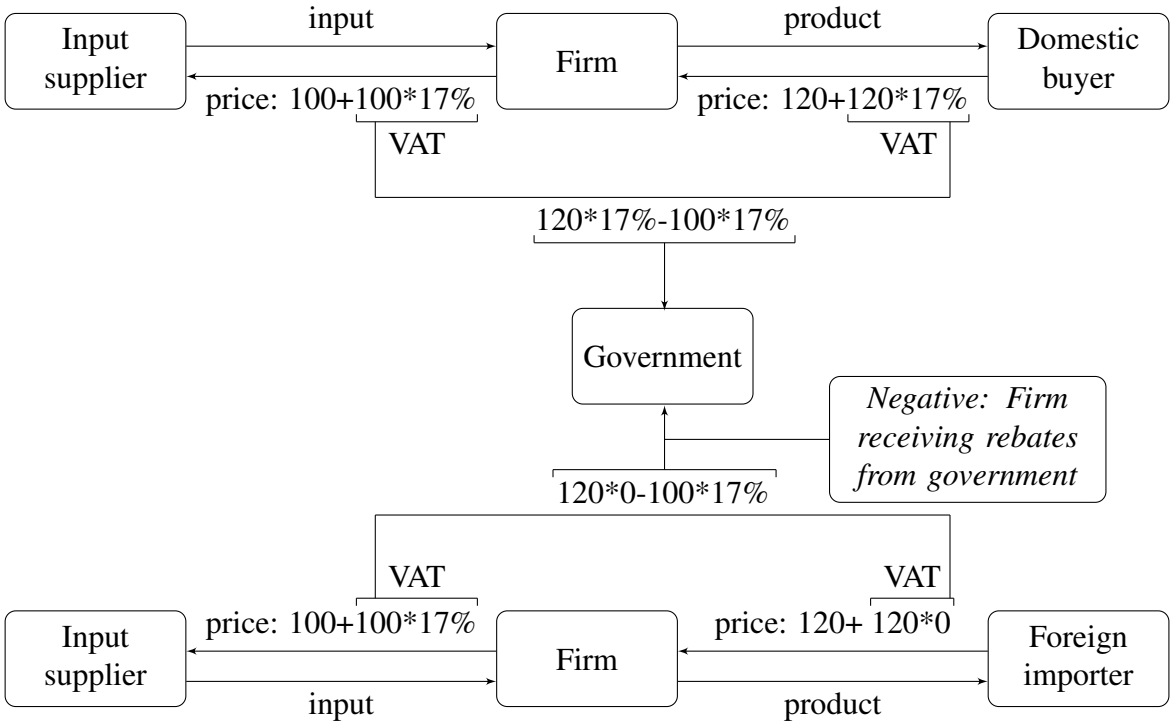

Figure 1: The policy of export VAT rebates

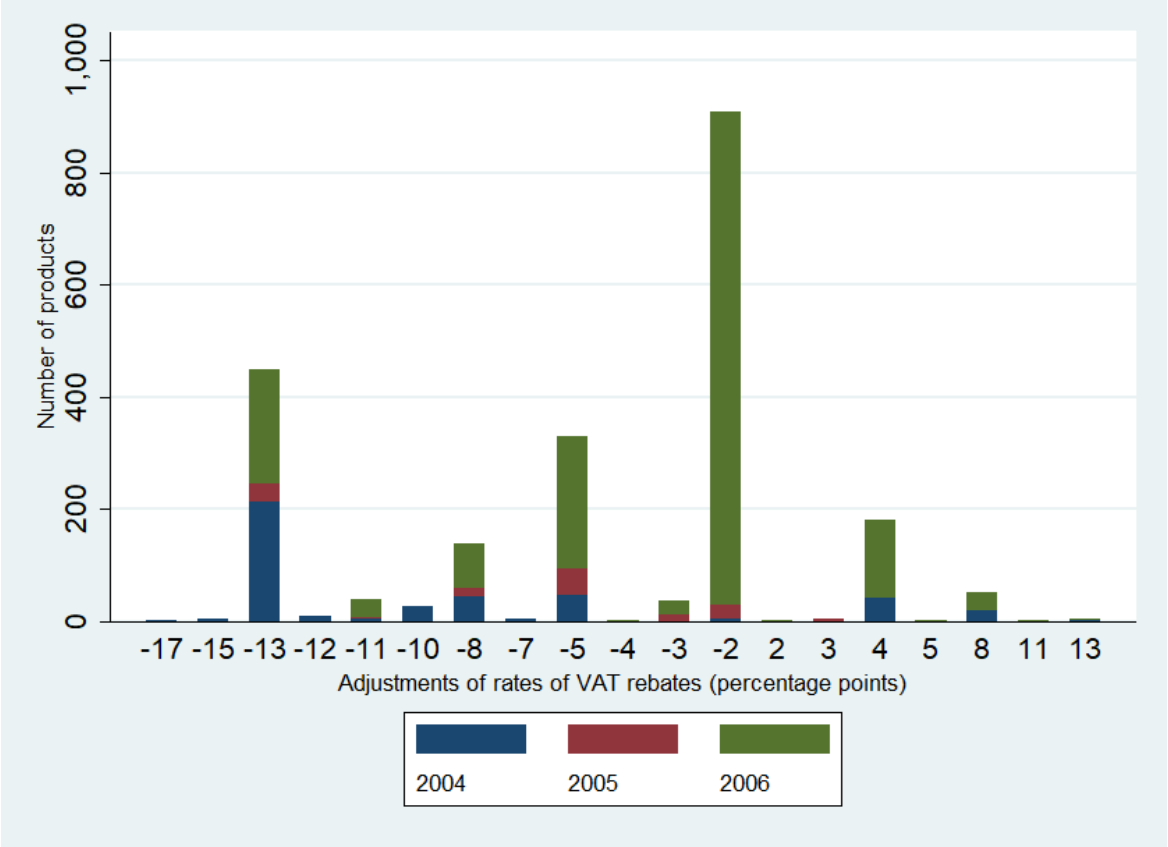

Figure 2: The employment effects due to VAT rebates' adjustment

Table 1: The employment and wage effects of VAT rebates

	(1)	(2)	(3)	(4)
		Panel A: ln employment		
$FVATR$	0.128	0.041	0.283	0.236
	(0.087)	(0.076)	(0.088)***	(0.077)***
$Adj.R^2$	0.918	0.940	0.920	0.942
# observations	97,115	97,115	97,115	97,115
		Panel B: ln wage		
$FVATR$	-0.676	-0.381	-0.060	-0.027
	(0.101)***	(0.093)***	(0.092)	(0.091)
$Adj.R^2$	0.557	0.637	0.615	0.654
# observations	93,362	93,362	93,362	93,362
Controls	NO	YES	NO	YES
Firm fixed effects	YES	YES	YES	YES
Year fixed effects	NO	NO	YES	YES

The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

Table 2: Robustness checks on alternative export share and product entry and exit

	(1) Mean	(2) Lag_1	(3) Lag_2	(4) Initial	(5) Initial	(6) Mean	(7) Mean
				Panel A: ln employment			
$FVATR$	0.236	0.224	0.228	0.422	0.405	0.393	0.359
	(0.078)***	(0.078)***	(0.079)***	(0.060)***	(0.078)***	(0.066)***	(0.075)***
$Adj.R^2$	0.942	0.942	0.942	0.943	0.962	0.943	0.962
# observations	95,372	95,236	94,681	130,472	69,773	130,472	69,773
				Panel B: ln wage			
$FVATR$	-0.044	-0.048	-0.038	-0.037	0.041	-0.063	0.019
	(0.091)	(0.092)	(0.092)	(0.072)	(0.098)	(0.077)	(0.094)
$Adj.R^2$	0.654	0.654	0.654	0.668	0.699	0.668	0.699
# observations	91,683	91,546	91,009	126,042	62,847	126,042	62,847
Product entry/exit	—-	—-	—-	NO	YES	NO	YES
Controls	YES	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES

In columns (1)-(3), we use alternative export share to calculate firm-specific rate of VAT rebates: the mean export share from the initial year to the last year, the export share lagged by one year and the export share lagged by two years. In columns (4)-(7), we consider product entry and exit within firms. We construct every firm's product mix that consists of all products exported from the initial year to the last year in our sample and use the initial export share of each product (columns (4)-(5)) and mean export share from the initial year to last year (columns (6)-(7)) to calculate firm-specific rate of VAT rebates. "Product entry/exit" indicates a dummy variable to denote whether the firm drops a product and a dummy variable to denote whether the firm adds a product. The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

Table 3: Robustness checks on small exporters, processing trade, product aggregation, bonded materials and export size

	(1) Small exporter	(2) Small exporter	(3) Ordinary trade	(4) Aggregation 6-digit HS	(5) Bonded Material	(6) Export size
			Panel A: ln employment			
$FVATR$	0.219	0.261	0.457	0.214	0.237	0.279
	(0.085)**	(0.101)***	(0.155)***	(0.078)***	(0.077)***	(0.103)***
$Adj.R^2$	0.936	0.941	0.938	0.942	0.942	0.942
# observations	82,394	14,147	51,562	94,494	97,106	97,115
			Panel B: ln wage			
$FVATR$	-0.043	0.075	0.091	-0.041	-0.025	-0.124
	(0.098)	(0.136)	(0.166)	(0.093)	(0.090)	(0.113)
$Adj.R^2$	0.631	0.680	0.664	0.652	0.653	0.654
# observations	79,267	13,542	49,574	90,787	93,370	93,362
Controls	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES

In columns (1) and (2), we use the sample of small exporters: defined as firms whose export share for each HS 8-digit product out of total export value of the product is less than 5% and as firms whose total export value is below the 20th percentile in the firms in the same sector. In column (3), we use the sample of firms that only conduct ordinary trade. In column (4), we aggregate the trade data at 6 digit HS level and then calculate firm-specific rate of VAT rebates. In column (5), we exclude bonded materials from export value. In column (6) , we use the firm-specific rate of VAT rebates scaled by the initial share of exports in total sales. The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

Table 4: The heterogeneity of the employment and wage effects in firm productivity

	(1) Low	(2) High	(3) All	(4) All	(5) All
			Panel A: ln employment		
$FVATR$	0.313	0.122	0.739	0.874	0.993
	(0.103)***	(0.114)	(0.262)***	(0.314)***	(0.291)***
TFP_initial $\times FVATR$			-0.135		
			(0.067)**		
TFP_2003 $\times FVATR$				-0.188	
				(0.083)**	
TFP $\times FVATR$					-0.200
					(0.073)***
TFP					0.154
					(0.011)***
$Adj.R^2$	0.909	0.942	0.942	0.942	0.944
# observations	48,930	48,185	97,115	54,349	97,115
			Panel B: ln wage		
$FVATR$	-0.015	-0.073	0.513	0.062	0.194
	(0.120)	(0.138)	(0.450)	(0.635)	(0.379)
TFP_initial $\times FVATR$			-0.149		
			(0.124)		
TFP_2003 $\times FVATR$				-0.045	
				(0.176)	
TFP $\times FVATR$					-0.061
					(0.101)
TFP					0.023
					(0.014)*
$Adj.R^2$	0.611	0.670	0.653	0.658	0.653
# observations	47,160	46,202	93,362	52,699	93,362
Controls	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES

In columns (1) and (2) we use firms with low initial productivity and firms with high initial productivity, respectively. In columns (3)-(5) we introduce interaction terms between firm-specific rate of VAT rebates and initial productivity, productivity in 2003 and contemporaneous productivity. Note that in columns (3) and (4), the coefficients of initial productivity and productivity in 2003 are absorbed by firm fixed effects. The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

A Online Appendix

A.1 Adjustments of the rates of VAT rebates

There were four major adjustments during this period: the adjustments in January 2004, May 2005, January 2006 and September 2006. More specifically, 365 products, 94 products, 137 products and 1,497 products received different rates of VAT rebates at these time points respectively. Table A1 reports the descriptive statistics of these major adjustments. For the adjustments at other times, fewer than 40 products were affected.

Table A 1: Major adjustments of the rates of VAT rebates between 2003 and 2006

Circular Title	Adjustment	Number	Adjustment	Number
Cai Shui [2003] 222 Hao	-17	1	-15	5
Release on 13/10/2003	-13	213	-12	8
Effective from 01/01/2004	-10	25	-8	44
	-7	3	-5	45
	-2	3	8	18
Cai Shui [2005] 75 Hao	-13	6	-8	2
Release on 29/04/2005	-5	45	-3	11
Effective from 01/05/2005	-2	25	+3	5
Cai Shui [2005] 184 Hao	-13	67	-8	16
Release on 23/12/2005	-5	27	-3	24
Effective from 01/01/2006	+5	1	+11	1
	+13	1		
Cai Shui [2006] 139 Hao	-13	136	-11	30
Release on 14/09/2006	-8	64	-5	210
Effective from 15/09/2006	-4	2	-2	881
	+2	2	+4	140
	+8	32		

Source: The Taxation Law Database of State Administration of Taxation, http://www.chinatax.gov.cn. "-" means that the rates of VAT rebates are reduced and "+" means that the rates of VAT rebates are increased. "Number" means number of products.

The Circulars from 2003 to 2006 include: Cai Shui [2003] 222 Hao, Cai Shui Ming Dian [2004] 1 Hao, Cai Shui Ming Dian [2004] 2 Hao, Cai Shui Ming Dian [2004] 3 Hao, Cai Shui [2004] 200 Hao, Cai Shui [2004] 201 Hao, Cai Shui [2004] 214 Hao, Cai Shui [2004] 224 Hao, Cai Shui [2005] 51 Hao, Cai Shui [2005] 57 Hao, Cai Shui [2005] 75 Hao, Cai Shui [2005] 93 Hao, Cai Shui [2005] 119 Hao, Cai Shui [2005] 133 Hao, Cai Shui [2005] 184 Hao, Cai Shui [2006] 6 Hao, Cai Shui [2006] 42 Hao, Cai Shui [2006] 139 Hao, Cai Shui [2006] 145 Hao, Cai Shui [2006] 1263 Hao.

A.2 Data

A.2.1 Transaction-level trade

Processing trade with purchased materials (PTPM), also known as import-assembly trade, refers to "business activities in which the operating enterprise imports materials/parts by paying foreign exchange for their processing and exports finished processed products for sale abroad". Processing trade with supplied materials (PTSM), also known as pure assembly trade, refers to "the business activities in which the imported materials are supplied by the overseas enterprise, and the operating enterprise need not pay foreign exchange for the import, but just carries out processing or assembling in accordance with the requirements of the overseas enterprise, and charges for the processing, with the finished products being marketed by the overseas enterprise". These definitions come from Order No.113 of the General Administration of Customs of the People's Republic of China "Measures of the Customs of the People's Republic of China on the Supervision of Processing Trade Goods".

A.2.2 Merge data

In the main paper, we have discussed the criteria to clean the CASMF: (1) missing values on firm name or duplicated firm name in each year; (2) missing values or non-positive values on firm employment and wage bills; (3) non-positive values of sales and total asset; (4) export value larger than sales; (5) fixed asset or variable asset larger than total asset. In table A2, we present the number of firms after cleaning the data from CASMF after these criteria. In total around 1.5% firms are dropped in 2003 and 2004 and around 1% firms are dropped in 2005 and 2006. Finally, we have around 192,000 firms in 2003 and 298,000 firms in 2006. Among them, around 51,000 firms are exporters in 2003 and 79,000 firms are exporters in 2006. In the sample combining CCTD and product-level rate of VAT rebates, we have around 87,000 exporters in 2003 and 160,000 exporters in 2006.

To merge the sample of exporters after combining Chinese Customs Trade Database (CCTD) with product-level VAT rebates and the firm-level production data comes from Chinese annual survey of manufacturing firms (CASMF), we mainly rely on firm name. Though there is a unique identifier code for each firm in the CASMF and CCTD, but it is generated according to different coding systems. Therefore it cannot be used to merge the two data. In some firm names, there are brackets that use Chinese and western style respectively in the two data sources. In the merged sample, we have around 27,000 exporters in 2003 and 51,000 exporters in 2006.It should be noted that in CASMF, all firms are manufacturing firms and can be divided into above-scale non-exporters, above-scale exporters trading di-

rectly and above-scale exporters trading with agents. In CCTD, firms can be divided into above-scale exporters trading directly, trading agents, small-scale manufacturing exporters and non manufacturing exporters. Thus, only the above-scale exporters trading directly are merged (e.g. see Wang and Yu, 2012).

Table A 2: The process of merging data

	CASMF						CCTD and	
	(1)	+(2)	+(3)	+(4)	+(5)		VAT rebates	Merged
Year	Firms	Firms	Firms	Firms	Firms	Exporters	Exporters	sample
2003	196,102	194,483	192,710	192,710	192,705	50,831	87,481	26,721
2004	276,410	274,340	272,282	272,282	272,274	76,903	106,618	42,605
2005	271,738	270,105	269,176	269,174	269,151	75,514	113,474	43,966
2006	301,849	299,508	298,824	298,824	298,765	79,150	159,697	51,073

The quality of merged data is described in table A3. On average, the merged data accounts for 35% of exporters and nearly 50% of export value in CCTD . It also accounts for 58% of exporters and 67% of export value in the cleaned CASMF. Moreover, the merged data contains more than 50% of the sales, employment and asset of exporters in the cleaned CASMF.

Table A 3: The quality of merged data

	CCTD and VAT rebates		Exporters in CASMF				
Year	Number	Exports	Number	Exports	Sales	Employment	Asset
2003	30.54%	41.46%	52.57%	60.23%	52.23%	49.47%	48.69%
2004	39.96%	52.16%	55.40%	69.57%	59.34%	56.10%	57.28%
2005	38.75%	51.61%	58.22%	67.53%	56.87%	55.26%	54.30%
2006	31.98%	47.62%	64.53%	70.84%	59.44%	58.01%	56.39%
Mean	35.31%	48.21%	57.68%	67.04%	56.97%	54.71%	54.17%

A.2.3 Description of regression sample

In table A4, we describe how we process the merged data to get the sample used in the estimations of the employment and wage effects. The number of firms in each year in the merged sample is presented in column (1), which is the same as the number in the last column of table A2. After dropping around 10,000 observations with missing values in the control variables used in the estimations of the employment effect (see table A5 for the variables), we have around 153,900 observations as shown in column (2). Then we drop around 28,000 observations with missing values on firm-specific rate of VAT rebates, we

have around 125,500 observations as shown in column (3). These dropped observations are mainly those firms with product entry and exit after the initial year. Among the left observations, there are firms that are only present in a single year as shown in column (4). These firms either exit the market in 2004 (singleton observations in 2003), or only survive one year (singleton observations in 2004 and 2005), or new exporters (singleton observations in 2006). As we use panel data method, we essentially use the within-firm variations. Therefore, these observations are dropped automatically in the estimations. Therefore, we essentially estimate the employment effect with the observations shown in column (5). We further drop the observations with missing values on the additional control variables in the wage equation, we are left with the observations shown in column (6), which are then used in the wage equation.

Table A 4: The processing of merged data

Year	(1) Merged sample	(2) Drop obs. with missing control variables in employment estimation	(3) Drop obs. with missing firm-specific rate of VAT rebates	(4) Singleton obs.	(5) Drop Singleton obs.	(6) Drop obs. with missing additional control variables in wage estimation
2003	26,721	24,719	24,719	7,362	17,357	17,213
2004	42,605	39,184	35,068	5,583	29,485	28,897
2005	43,966	41,820	36,213	4,600	31,613	28,864
2006	51,073	48,213	29,524	10,864	18,660	18,388
Total	164,365	153,936	125,524	28,409	97,115	93,362

The description of the regression sample, i.e. the sample shown in the columns (5) and (6) of table A4, is presented in table A5.

Table A 5: The description of regression data

Variable	Obs	Mean	Std.dev	Min	Max
ln employment	97,115	5.34	1.09	2.08	10.59
ln wage	97,115	2.64	0.56	-3.14	6.92
$FVATR$ (%)	97,115	12.46	2.67	0	17.00
Control variables in employment equation					
ln value-added per capita	97,115	3.90	1.06	-4.16	9.30
ln firm_GDP per capita	97,115	9.93	0.82	-1.35	11.28
ln firm_population	97,115	4.19	1.17	-9.33	7.01
ln firm_distance	97,115	8.42	0.73	3.83	9.86
Capital-labor ratio	97,115	3.52	1.37	-4.35	10.22
Share of value-added in output	97,115	0.25	0.14	0	1.00
Share of domestic sales in total sales	97,115	0.43	0.41	0	1.00
Share of non-eligible exports in total exports	97,115	0.07	0.23	0	1.00
ln firm age	97,115	2.00	0.68	0	4.62
(Additional) control variables in wage equation					
Unemployment rate (%)	93,362	3.59	0.81	1.30	6.50
Labor market tightness	93,362	1.22	0.90	0.34	6.66
Labor market matching efficiency	93,362	0.50	0.08	0.11	0.90

Please see section 3.2 of the main paper on how the variables are measured.

A.3 Full tables on the employment and wage effects

Table A 6: The full table on the employment effect of VAT rebates

	(1)	(2)	(3)	(4)
$FVATR$	0.128	0.041	0.283	0.236
	(0.087)	(0.076)	(0.088)***	(0.077)***
ln wage		-0.068		-0.101
		(0.005)***		(0.005)***
ln value-added per capita		-0.137		-0.163
		(0.005)***		(0.005)***
ln firm_GDP per capita		0.010		0.002
		(0.003)***		(0.003)
ln firm_population		0.014		0.011
		(0.002)***		(0.002)***
ln firm_distance		0.028		0.012
		(0.005)***		(0.005)***
Capital-labor ratio		-0.226		-0.225
		(0.005)***		(0.005)***
Share of value-added		0.459		0.532
		(0.019)***		(0.020)***
Share of domestic sales		-0.028		-0.036
		(0.007)***		(0.006)***
Share of non-eligible exports		-0.076		-0.062
		(0.020)***		(0.020)***
ln firm age		0.275		0.145
		(0.007)***		(0.007)***
_cons	5.329	5.804	5.310	6.434
	(0.011)***	(0.050)***	(0.011)***	(0.052)***
Firm fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
$Adj.R^2$	0.918	0.940	0.920	0.942
# observations	97,115	97,115	97,115	97,115

Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

Table A 7: The full table on the wage effect of VAT rebates

	(1)	(2)	(3)	(4)
FVATR	-0.676	-0.381	-0.060	-0.027
	(0.101)***	(0.093)***	(0.092)	(0.091)
ln employment		-0.114		-0.150
		(0.008)***		(0.008)***
ln value-added per capita		0.203		0.161
		(0.005)***		(0.005)***
ln firm_GDP per capita		0.004		0.000
		(0.003)		(0.003)
ln firm_population		0.004		0.003
		(0.003)		(0.003)
ln firm_distance		0.015		-0.000
		(0.006)***		(0.005)
Capital-labor ratio		0.047		0.039
		(0.004)***		(0.004)***
Share of value-added		-0.527		-0.410
		(0.021)***		(0.021)***
Share of domestic sales		-0.008		-0.008
		(0.008)		(0.008)
Share of non-eligible exports		0.043		0.060
		(0.022)**		(0.021)***
ln firm age		0.175		0.050
		(0.007)***		(0.007)***
Unemployment rate		-0.151		0.067
		(0.007)***		(0.008)***
Labor market tightness		-0.005		-0.002
		(0.002)***		(0.002)
Labor market matching efficiency		0.003		-0.050
		(0.029)		(0.029)*
_cons	2.705	2.470	2.629	2.451
	(0.013)***	(0.081)***	(0.011)***	(0.079)***
Firm fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
$Adj.R^2$	0.557	0.637	0.615	0.654
# observations	93,362	93,362	93,362	93,362

Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

A.4 Additional analysis

In this section, we provide additional analysis on the effects of VAT rebates. To explore the impact of VAT rebates on other firm-level variables, we estimate a specification similar to equation (11), in which we replace dependent variable with other firm-level variables.

Exports

The first additional analysis is about the exports. The results on export value and export quantity are shown in columns (1) and (2) of table A8. As shown in the columns, higher VAT rebates significantly increase firms' export value and export quantity. Moreover, we calculate firm-level export price as firm's export value divided by export quantity. As shown in the column (3), export price also increases with higher VAT rebates. To the extent that export price serves as a proxy for export quality, the result suggests that firms may upgrade export quality in response to higher VAT rebates.

Financial Constraints

The increases in VAT rebates essentially represent cash flows back to firms, potentially relaxing firms' financial constraints. To investigate the effect of VAT rebates on firms' financial constraints, we follow Manova and Yu (2016) to construct two measures of firms' financial constraints:

$$liquidity_{it} = \frac{\text{current assets}_{it} - \text{current liabilities}_{it}}{\text{total assets}_{it}}$$

and

$$leverage_{it} = \frac{\text{current liabilities}_{it}}{\text{current assets}_{it}}.$$

Liquidity measures firms' liquid capital, while leverage shows to what extent firms are constrained to manage cash flows or to raise external capital. As a result, the higher the liquidity is and the lower the leverage is, the less financially constrained the firms are. The results on the financial constraints are shown in columns (4) and (5) of table A8. As shown in column (4), an increase in the firm-specific rate of VAT rebates raises firms' liquidity. This suggests that higher VAT rebates make firms less financially constrained. As shown in column (5), firms' leverage decreases when firm-specific rate of VAT rebates is higher. This again suggests that financial constraints are relaxed with higher VAT rebates.

Investment and Materials

Finally, we investigate the effects of VAT rebates on firms' investment and use of materials. This analysis sheds lights on whether firms adjust investment and the use of materials when receiving more VAT rebates. The investment of firm i in year t is measured as $Investment_{it} = k_{it+1} - k_{it} + Depreciation_{it}$, where $k_{it(+1)}$ is the value of capital of firm i in year $t(+1)$ and $Depreciation_{it}$ is value of depreciation of firm i in year t. The results are presented in columns (6) and (7) of table A8. The effects of VAT rebates on investment and the use of materials are not significant, suggesting that firms do not adjust investment and the use of materials when facing different VAT rebates.

Table A 8: Additional analysis of the effects of VAT rebates

	(1) Export value	(2) Export quantity	(3) Export price	(4) Liquidity	(5) Leverage	(6) Investment	(7) Materials
FVATR	2.458	1.599	0.860	0.187	-0.895	0.031	0.247
	(0.561)***	(0.606)***	(0.317)***	(0.106)*	(0.543)*	(0.527)	(0.160)
Controls	YES	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES
$Adj.R^2$	0.787	0.853	0.904	0.602	0.328	0.622	0.878
# observations	94,502	94,502	94,502	96,285	96,285	49,423	97,115

In columns (1)-(5), the control variables include firm productivity, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. In columns (6) and (7), the control variables include firm productivity, firm-level demand shocks, firm-level variable trade cost, firm-level demand shocks, firm-level variable trade cost, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

A.5 Other robustness checks

In the main analysis, we control for firm productivity (labor productivity) using value added per capita in the estimations of the employment and wage effects. In table A9, we report the results using total factor productivity (TFP). More specifically, TFP estimated from Levinsohn and Petrin (2003) approach in which materials are used to control for the unobserved productivity is used in column (1) while TFP estimated from Olley and Pakes (1996) approach in which investment is used to control for the unobserved productivity is used in column (2). In columns (3) and (4), TFP is estimated from Ackerberg et al. (2015) approach with investment and materials are used to control for unobserved productivity, respectively. All results are consistent with the baseline results.

Table A 9: The employment and wage effects: alternative controls of firm productivity

	(1)	(2)	(3)	(4)
		Panel A: ln employment		
$FVATR$	0.183	0.204	0.192	0.199
	(0.076)**	(0.077)***	(0.077)**	(0.077)***
$Adj.R^2$	0.939	0.939	0.939	0.939
# observations	97,515	97,515	97,515	97,515
		Panel B: ln wage		
$FVATR$	0.025	0.026	0.031	0.026
	(0.092)	(0.092)	(0.092)	(0.092)
$Adj.R^2$	0.641	0.640	0.640	0.640
# observations	93,755	93,755	93,755	93,755
Controls	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES

Other control variables in the employment equation include firm wage, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Other control variables in the wage equation include firm employment, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

In table A10, we provides more results on the robustness checks. In column (1), we follow Olley and Pakes (1996) and address the potential bias from firm exit by modeling the probability to survive in the foreign market as a function of observed variables. We define an indicator *Survival* to be one if the firm continues to export and zero if the firm exits. We use firm-level production data of year 2007 in CASMF to identify whether the firms in year 2006 continue to export in year 2007. We estimate the probability to survive $Pr(Survival_{it} = 1) = \Phi(FVATR_{it-1}, X_{it-1}, \varsigma_t, \varepsilon_{it})$ and use the predicted probability to survive as an additional control variable to estimate the employment and wage effects. In column (2), we regress the lagged firm-specific rate of VAT rebates by one year on the contemporaneous employment and wage. In column (3) we exclude outliers whose employment (wage) is at the top 5% or bottom 5% of all firms in each sector. In column (4) and (5), we replace year fixed effects with stricter sector-year fixed effects. All results are consistent.

Table A 10: Other robustness checks on the employment and wage effects of VAT rebates

	(1) Firm exit	(2) Time lag	(3) Outliers	(4) Sector-year fixed effects	(5) Sector-year fixed effects
			Panel A: ln employment		
FVATR	0.658	0.153	0.181	0.235	0.150
	(0.087)***	(0.081)*	(0.077)**	(0.089)***	(0.078)*
$Adj.R^2$	0.942	0.953	0.922	0.925	0.943
# observations	97,115	84,099	87,087	97,113	97,113
			Panel B: ln wage		
FVATR	0.113	0.104	-0.007	0.005	0.015
	(0.102)	(0.095)	(0.066)	(0.094)	(0.095)
$Adj.R^2$	0.654	0.685	0.694	0.637	0.655
# observations	93,362	80,799	81,808	93,361	93,361
Controls	YES	YES	YES	NO	YES
Firm fixed effects	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	Sector-year fixed effects	

The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

A.6 Robustness on the heterogeneity in firm productivity

In the main analysis of heterogeneous employment and wage effects, we use TFP estimated from Levinsohn and Petrin (2003) approach to classify whether a firm is a low-productivity firm or a high-productivity firm. In table A11, we report the results using TFP estimated from Olley and Pakes (1996) approach to classify firms in columns (1) and (2), using TFP estimated from Ackerberg et al. (2015) approach with investment to control for unobserved productivity in columns (3) and (4), and using TFP estimated from Ackerberg et al. (2015) approach with materials to control for unobserved productivity in columns (5) and (6). The results are robust.

Table A 11: Heterogeneity in alternative firm productivity

	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High
			Panel A: ln employment			
$FVATR$	0.268	0.154	0.276	0.191	0.372	0.105
	(0.106)**	(0.109)	(0.118)**	(0.100)*	(0.114)***	(0.103)
$Adj.R^2$	0.945	0.940	0.941	0.944	0.943	0.942
# observations	53,699	43,416	52,212	44,903	53,265	43,850
			Panel B: ln wage			
$FVATR$	-0.183	0.125	-0.089	0.013	-0.133	0.063
	(0.117)	(0.139)	(0.129)	(0.127)	(0.117)	(0.136)
$Adj.R^2$	0.649	0.648	0.638	0.665	0.614	0.670
# observations	51,970	41,392	50,526	42,836	51,676	41,686
Controls	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES

The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

In tables A12 and A13, we additionally control for the interaction terms between firm-specific rate of VAT rebates and other variables that are potentially correlated with firm productivity, i.e. capital intensity and skill intensity. More specifically, we use firms' capital-labor ratio in their initial year and in 2003 as well as the contemporaneous capital-labor ratio. We measure skill intensity using the percentage of skilled workers, defined as the workers with college degree, bachelor degree, master degree or above, in the employment. The data on the skill composition of employment is only available in 2004. Therefore, we use the skill intensity in 2004. The results on the heterogeneous employment and wage effects in firm productivity are robust.

Table A 12: Heterogeneous employment effect in firm productivity: additional controls

	(1)	(2)	(3)	(4)	(5)	(6)
$FVATR$	0.725	1.013	0.886	0.994	1.099	1.248
	(0.299)**	(0.324)***	(0.386)**	(0.422)**	(0.347)***	(0.377)***
TFP_initial $\times FVATR$	-0.135	-0.142				
	(0.067)**	(0.073)*				
TFP_2003 $\times FVATR$			-0.188	-0.187		
			(0.082)**	(0.085)**		
TFP $\times FVATR$					-0.200	-0.176
					(0.072)***	(0.077)**
TFP					0.154	0.145
					(0.011)***	(0.012)***
Capital-labor_initial $\times FVATR$	0.005	-0.031				
	(0.053)	(0.066)				
Capital-labor_2003 $\times FVATR$			-0.003	-0.012		
			(0.074)	(0.095)		
Capital-labor $\times FVATR$					-0.032	-0.069
					(0.060)	(0.073)
Skill-intensity_2004 $\times FVATR$		-1.318		-0.910		-1.079
		(0.592)**		(0.797)		(0.582)*
$Adj.R^2$	0.942	0.943	0.942	0.943	0.944	0.944
# observations	97,115	85,895	54,349	50,893	97,115	85,895
Controls	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES

The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.

Table A 13: Heterogeneous wage effect in firm productivity: additional controls

	(1)	(2)	(3)	(4)	(5)	(6)
$FVATR$	0.828	0.767	0.373	0.401	0.569	0.445
	(0.496)*	(0.543)	(0.723)	(0.772)	(0.435)	(0.465)
TFP_initial $\times FVATR$	-0.149	-0.151				
	(0.124)	(0.138)				
TFP_2003 $\times FVATR$			-0.054	-0.062		
			(0.178)	(0.192)		
TFP $\times FVATR$					-0.061	-0.053
					(0.102)	(0.111)
TFP					0.022	0.021
					(0.014)*	(0.015)
Capital-labor_initial $\times FVATR$	-0.096	-0.039				
	(0.063)	(0.069)				
Capital-labor_2003 $\times FVATR$			-0.080	-0.017		
			(0.086)	(0.087)		
Capital-labor $\times FVATR$					-0.113	-0.049
					(0.061)*	(0.064)
Skill-intensity_2004 $\times FVATR$		-1.826		-1.656		-1.847
		(0.990)*		(1.188)		(0.972)*
$Adj.R^2$	0.654	0.657	0.658	0.662	0.654	0.657
# observations	93362	82850	52699	49441	93362	82850
Controls	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES

The control variables in the employment equation include firm wage, value added per capita, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. The control variables in the wage equation include firm employment, value added per capita, unemployment rate, labor market tightness, labor market matching efficiency, firm-level demand shocks, firm-level variable trade cost, capital intensity, the share of value-added in total output, the share of domestic sales, the share of non-eligible exports and firm age. Standard errors are clustered at firm level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significant levels respectively.